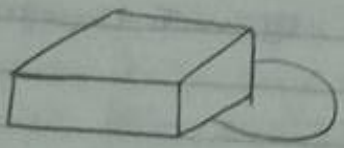
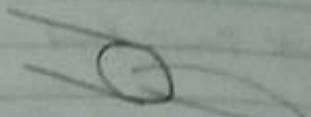
Antenna

2- Aperture antenna

1- Wave guide antenna



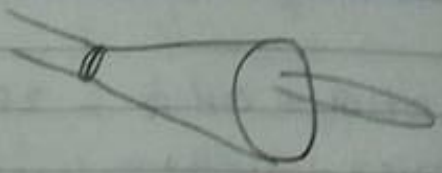
rectangular W.G antenna



circular W.G antenna

<< Directivity as the radiating area increase, the Directivity increase

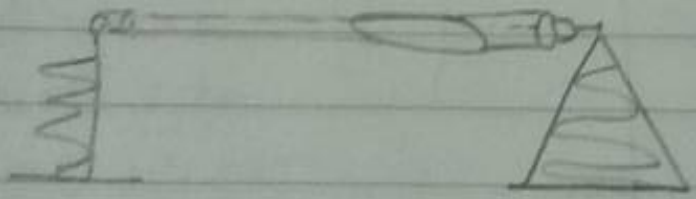
rectangular (horn) antenna



circular (horn) antenna

* APPLICATIONS

(1) very directive so it can be used to connect base stations together



B.S B.S

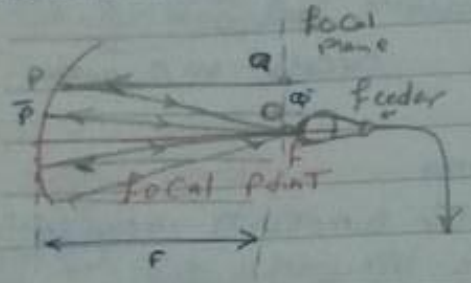
* used for space crafts

* used for Microwave links

[3] reflector Antenna

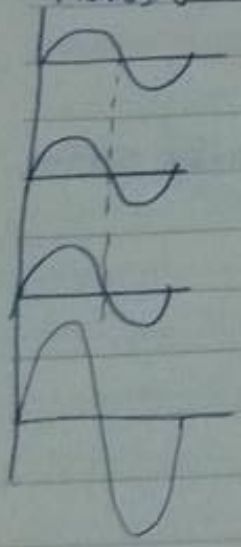
* Parabolic reflector antennas

① With Front feed



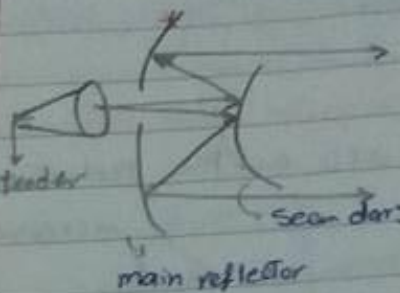
$OPQ = OP'Q' = 2F$

Phase ... [illegible]



* ① Provide very high gain
So, it is suitable for satellite communication ∴ Why
② The path lengths from focal point to reflector surface and back to the focal plane are equal.

② With Cassegrain feed



* It provides higher gain than the Front feed, as the secondary reflector increases the effective radiating area $G = \frac{4\pi A_{eff}}{\lambda^2}$

*

* $PP + PQ = 2F$

from ... to ... ذهبت

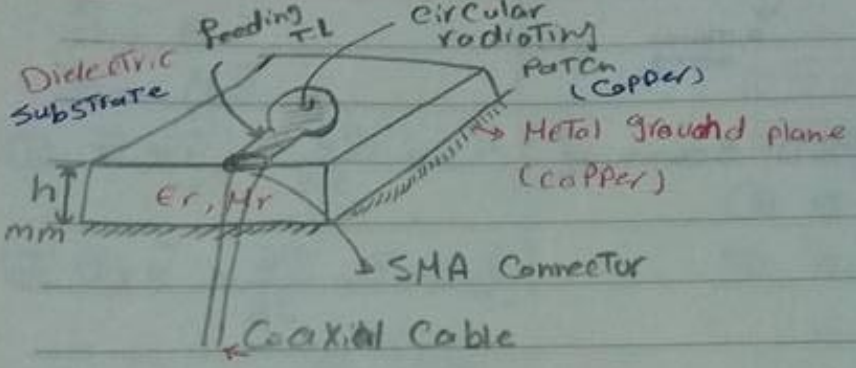
So The delay for all waves is equal

* The waves will have The same phase ∴ So They add Together giving high gain

(2) all The incident Parallel rayes will be reflected at one Point (Focal Point)

*

(4) Micro STRIP anTenna :



حجم صغير جداً
وزن صغير جداً
كما هو هذه مادة فازلت
مطلية بالنحاس

* Advantages

(1) small size

(2) LighT weighT

(3) low CosT

* APPLicaTion :

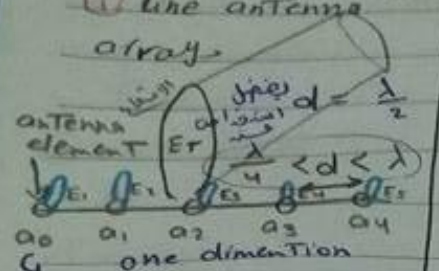
(1) Used for Mobile and labTops

(2) Used for inTegraTed MicroWave CirCuiTs

Mechanical scanning — electronic scanning

* Antenna arrays — مصفوفات الهوائيات

① Line antenna array

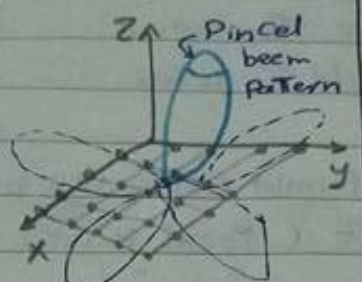


one dimention

excitation coefficient (current)

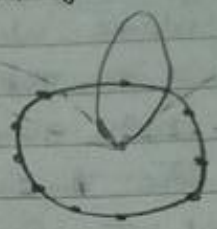
* 1-D scanning

② Planar antenna array



* 2D scanning

③ Circuler antenna array



* 2D-scanning

* Advantages of antenna arrays

[1] The total field pattern (E_T) emitted from the antenna array is the summation of the individual fields from each antenna element

$E_T = E_1 + E_2 + \dots + E_N$

(N , d , an)

N ↑ عدد ال element

d ↓ المسافة

$|a_0|$ ↓ $I d_0$ e ↘ phase

[2] higher gain

[3] higher directivity

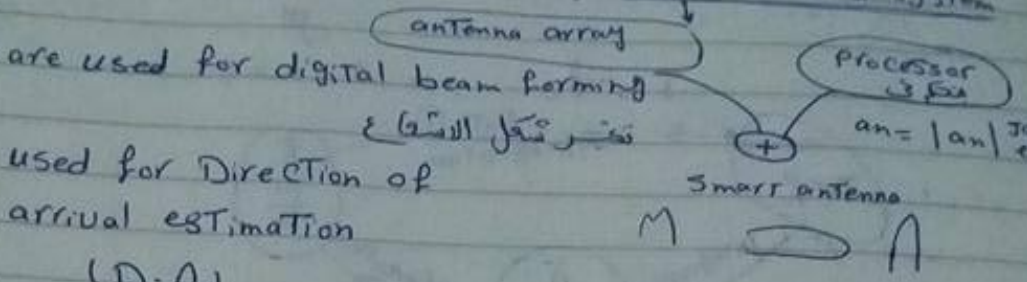
$G \propto D$

[4] high transmitted power, so it is used for long distance transmission.

5. antenna array is the core of any smart antenna system

6. are used for digital beam forming

7. used for Direction of arrival estimation (D.A)



* Maxwell's equations $\bar{E}, \bar{H}, M, \epsilon$ تربط بين المجال الكهربائي والمغناطيسي والوسط

1. Time varying fields

$$\bar{D} = \epsilon \bar{E}$$

$$\bar{B} = M \bar{H}$$

$$① \quad \bar{\nabla} \times \bar{E} = \frac{-\partial B}{\partial t} = -M \frac{\partial \bar{H}}{\partial t}$$

$$② \quad \bar{\nabla} \times \bar{H} = \frac{\partial D}{\partial t} + \bar{J} + \sigma \bar{E}$$

$$③ \quad \bar{\nabla} \times \bar{H} = \epsilon \frac{\partial \bar{E}}{\partial t} + \bar{J}$$ ($\bar{J}$: current intensity sources)

$$④ \quad \nabla \cdot \bar{D} = \rho_v$$ (ρ_v: volume charge density source)

$$⑤ \quad \nabla \cdot \bar{B} = 0$$

2. static fields

$$① \quad \bar{\nabla} \times E = 0$$

$$② \quad \bar{\nabla} \times \bar{H} = \bar{J}$$ → source

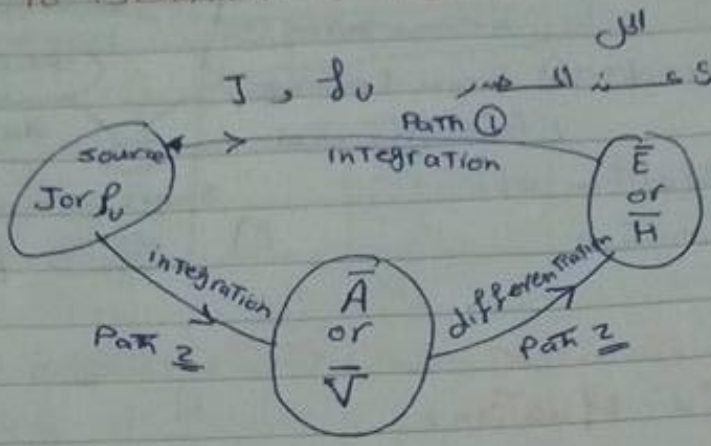
$$③ \quad \nabla \cdot \bar{D} = \rho_v$$

$$④ \quad \nabla \cdot B = 0$$

source لازم يكون في antenna في مسائل

* How To

How To Determine $\bar{E}$ and $\bar{H}$??



* $\bar{A}$ ⇒ Magnetic Potential vector

$\bar{J}$ ⇒ $\bar{A}$ ⇒ $\bar{H}$

* $\bar{V}$ ⇒ electric Potential vector

ρ_v ⇒ $\bar{V}$ ⇒ $\bar{E}$

* Power
* G
* D
* R

H , E دالة